IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Patent Application of

LAGRANGE et al.

Serial No. 10/774,399

Filed: February 10, 2004

Atty. Ref.: 839-1433

TC/A.U.: 3745

Examiner: C. Verdier

For: ADVANCED FIRTREE AND BROACH SLOT FORMS FOR TURBINE STAGE 3 BUCKETS AND ROTOR WHEELS

* *

March 6, 2008

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REPLACEMENT APPEAL BRIEF

Sir:

Appellant hereby appeals to the Board of Patent Appeals and Interferences from the last decision of the Examiner.

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(I)   **REAL PARTY IN INTEREST**

The real party in interest is General Electric Company, a corporation of the United States of America.

(II) RELATED APPEALS AND INTERFERENCES

The appellant, the undersigned, and the assignee are aware of the related appeal of patent application 10/774,400 filed on February 10, 2004 involving similar subject matter, naming the same inventors, and having the same assignee. Because the claims involved in the related appeal and the rejections thereof are obviously not identical to those involved in this appeal it cannot be conclusively predicted whether the related appeal will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

(III)   <u>STATUS OF CLAIMS</u>

Claims 1-9, 11 and 21-28 have been canceled. Claims 10, 12-20 and 29-62 are pending and claims 10, 12-20, 29-45, 48-49, 52-53, 55-56 and 59-60 have been rejected and are being appealed. Claims 46, 47, 50, 51, 54, 57, 58, 61 and 62 have been deemed to contain allowable subject matter but are objected to as being dependent upon a rejected base claim. The Examiner has stated that the objected to claims "would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims." See, Final Office Action at page 25.

(IV)   <u>STATUS OF AMENDMENTS</u>

An Amendment was erroneously filed concurrently with this Appeal Brief amending claim 29 to correct an antecedent basis problem identified by the Examiner in the Final Office Action. The Examiner properly refused entry of the Amendment in an Advisory Action on February 15, 2008. This improper Amendment is hereby withdrawn by Appellant.

(V)   SUMMARY OF CLAIMED SUBJECT MATTER

The invention of the claims relates to improved turbine buckets and wheel broach slots having dimensional relationships which reduce the number of buckets and corresponding wheel broach slots and the stresses acting on the buckets and wheel at the point of their attachment.

A listing of each appealed claim is given below including exemplary references to paragraph numbers of the specification and Figures of the application.

10.   A turbine having multiple turbine stages, a third turbine stage comprising:

a wheel having ninety wheelposts, each having an interleaved system of fillets and tangs; and

a plurality of buckets each having a corresponding interleaved system of fillets and tangs so that said plurality of buckets can be fitted, one to one, into said ninety wheelposts on said wheel [Figs. 1, 2A and 2B; Paragraphs 5, 26-28 and 32];

wherein said interleaved system of fillets and tangs on said buckets and wheelposts act to reduce stresses acting on said fitted buckets and wheelposts, the fillets and tangs of said interleaved system of fillets and tangs each being formed by a combination of curved and straight surfaces [Figs. 1, 2A and 2B; Paragraphs 29-31 and 33-36];

wherein the straight surfaces of each of the two uppermost tangs on either side of a center line bisecting each of said buckets define two points of a line that form an angle of 25.78° with the center line [Fig. 10; Paragraph 44]; and

wherein a point defined by intersecting tangent lines along the pressure faces of the bottommost tang does not lie on either line that forms the angle of 25.78° with the center line [Fig. 10; Paragraph 47].

12. A turbine as claimed in claim 10, wherein the fillets formed on said plurality of buckets have angles ranging from 50° to 59° [Fig. 9; Paragraph 46].

13. A turbine as claimed in claim 10, each one of said buckets and wheelposts having three interleaved tangs and fillets [Figs. 9 and 11; Paragraph 45].

14. A turbine as claimed in claim 13, wherein each of said buckets having a bottom tang formed from curved surfaces having more than one radius of curvature [Fig. 10; Paragraph 53].

15. A turbine as claimed in claim 14, wherein each of said buckets further includes at least one straight surface [Fig. 2A; Paragraph 29].

16. A turbine as claimed in claim 10, wherein each of said wheelposts having a bottom fillet formed from curved surfaces having more than one radius of curvature [Figs. 11 and 12; Paragraph 63].

17. A turbine as claimed in claim 16, wherein each of said wheelposts further includes at least one straight surface [Fig. 2B; Paragraph 33].

18. A turbine as claimed in claim 14, wherein said curved surfaces have radii

of curvatures of .1992 inches and .3360 inches [Fig. 10; Paragraph 53].

19.   A turbine as claimed in claim 16, wherein said curved surfaces have radii of curvatures of .2052 inches and .3420 inches [Figs. 11 and 12; Paragraph 63].

20.   A turbine as claimed in claim 10, wherein a top surface of each one of said wheelposts being scalloped so as to reduce the weight of said wheel [Figs. 7 and 8; Paragraph 39].

29.   A bucket for insertion into a wheelpost of a turbine rotor, said bucket being formed from interleaved fillets and tangs which complement interleaved fillets and tangs formed in the wheelpost,

wherein the straight surfaces of each of the two uppermost tangs on either side of a center line bisecting each of said buckets define two points of a line that form an angle of 25.78° with the center line [Fig. 10; Paragraph 44]; and

wherein a point defined by intersecting tangent lines along the pressure faces of the bottommost tang does not lie on either line that forms the angle of 25.78° with the center line [Fig. 10; Paragraph 47].

30.   A bucket as claimed in claim 29, said bucket having three interleaved tangs and fillets [Fig. 9; Paragraph 45].

31.   A bucket as claimed in claim 30, said bucket having a bottom tang formed from curved surfaces having more than one radius of curvature [Fig.10; Paragraph 53].

32.   A bucket as claimed in claim 31, said bucket further including at least one straight surface [Fig. 2A; Paragraph 30].

33.   A bucket as claimed in claim 31, said curved surfaces having radii of curvatures of .1992 inches and .3360 inches [Fig. 10; Paragraph 53].

34.   A bucket as claimed in claim 30, said bucket having an upper tang formed from curved surfaces having more than one radius of curvature [Fig. 2A; Paragraphs 29-30].

35.   A bucket as claimed in claim 31, said bucket having an upper tang formed from curved surfaces having more than one radius of curvature [Fig. 2A; Paragraphs 29-30].

36.   A bucket as claimed in claim 34, said bucket further including at least one straight surface [Fig. 2A; Paragraphs 29-30].

37.   A bucket as claimed in claim 30, said bucket having an intermediate tang formed from curved surfaces having more than one radius of curvature [Fig. 2A; Paragraphs 29-30].

38.   A bucket as claimed in claim 31, said bucket having an intermediate tang formed from curved surfaces having more than one radius of curvature [Fig. 2A; Paragraphs 29-30].

39.   A bucket as claimed in claim 35, said bucket having an intermediate tang

formed from curved surfaces having more than one radius of curvature [Fig. 2A; Paragraphs 29-30].

40.   A bucket as claimed in claim 37, said bucket further including at least one straight surface [Fig. 2A; Paragraphs 29-30].

41.   A turbine having multiple turbine stages, a third turbine stage comprising:

a wheel having ninety wheelposts, each having an interleaved system of fillets and tangs [Figs. 1, 2A and 2B; Paragraphs 5, 26-28 and 33-36]; and

a plurality of buckets each having a corresponding interleaved system of fillets and tangs so that said plurality of buckets can be fitted, one to one, into said ninety wheelposts on said wheel [Figs. 1, 2A and 2B; Paragraphs 29-31 and 33-36];

wherein said interleaved system of fillets and tangs on said buckets and wheelposts act to reduce stresses acting on said fitted buckets and wheelposts, the fillets and tangs of said interleaved system of fillets and tangs each being formed by a combination of curved and straight surfaces [Figs. 1, 2A and 2B; Paragraphs 11, 26, 29-31 and 33-36];

wherein above the uppermost tang on each of said buckets there is a compound fillet having a first radius of curvature of 0.3376 inches and a second radius curvature of 0.0718 inches [Fig. 10; Paragraph 55].

42.   The turbine as claimed in claim 41, wherein below the upper most tang on each of said buckets there is a fillet having a radius of curvature of 0.0656 inches [Fig. 10; Paragraph 55].

43.   The turbine as claimed in claim 42, wherein above the bottom most tang on each of said buckets there is a fillet having a radius of curvature of 0.0695 inches [Fig. 10, Paragraph 55].

44.   A turbine having multiple turbine stages, a third turbine stage comprising:

a wheel having ninety wheelposts, each having an interleaved system of fillets and tangs [Figs. 1, 2A and 2B; Paragraphs 5, 26-28 and 32]; and

a plurality of buckets each having a corresponding interleaved system of fillets and tangs so that said plurality of buckets can be fitted, one to one, into said ninety wheelposts on said wheel [Figs. 1, 2A and 2B; Paragraphs 29-31 and 33-36];

wherein said interleaved system of fillets and tangs on said buckets and wheelposts act to reduce stresses acting on said fitted buckets and wheelposts, the fillets and tangs of said interleaved system of fillets and tangs each being formed by a combination of curved and straight surfaces [Figs. 1, 2A and 2B; Paragraphs 11, 26, 29-31 and 33-36];

wherein for each one of said plurality of buckets the distance from the bottom of the bottom most tang to the upper most straight portion of the upper most fillet is 1.4530 inches [Fig. 9; Paragraph 50].

45.   The turbine as claimed in claim 44, wherein for each one of said plurality of buckets the distance from the bottom of the bottom most tang to a first intersection point of tangent lines drawn along pressure faces of the tang adjacent to the bottom

most tang is 0.5249 inches [Fig. 9; Paragraph 50].

48.   The turbine as claimed in claim 44, wherein for each one of said plurality of buckets the angle between the upper most straight portion of the upper most fillet and the upper most straight portion of the upper most tang is 50 degrees [Fig. 9, Paragraph 46].

49.   The turbine as claimed in claim 45, wherein for each one of said plurality of buckets the angle between the upper most straight portion of the upper most fillet and the upper most straight portion of the upper most tang is 50 degrees [Fig. 9, Paragraph 46].

52.   A turbine having multiple turbine stages, a third turbine stage comprising:

a wheel having ninety wheelposts, each having an interleaved system of fillets and tangs [Figs. 1, 2A and 2B; Paragraphs 5, 26-28 and 32]; and

a plurality of buckets each having a corresponding interleaved system of fillets and tangs so that said plurality of buckets can be fitted, one to one, into said ninety wheelposts on said wheel [Figs. 1, 2A and 2B; Paragraphs 29-31 and 33-36];

wherein said interleaved system of fillets and tangs on said buckets and wheelposts act to reduce stresses acting on said fitted buckets and wheelposts, the fillets and tangs of said interleaved system of fillets and tangs each being formed by a combination of curved and straight surfaces [Figs. 1, 2A and 2B; Paragraphs 11, 26, 29-31 and 33-36];

wherein below the uppermost tang on each of said wheelposts there is a fillet having a radius of curvature of 0.0855 inches [Fig. 12; Paragraph 64].

53.   The turbine as claimed in claim 52, wherein above the bottom most tang on each of said wheelposts there is a fillet having a radius of curvature of 0.0752 inches [Fig. 12; Paragraph 64].

55.   A turbine having multiple turbine stages, a third turbine stage comprising:

a wheel having ninety wheelposts, each having an interleaved system of fillets and tangs [Figs. 1, 2A and 2B; Paragraphs 5, 26-28 and 32]; and

a plurality of buckets each having a corresponding interleaved system of fillets and tangs so that said plurality of buckets can be fitted, one to one, into said ninety wheelposts on said wheel [Figs. 1, 2A and 2B; Paragraphs 29-31 and 33-36];

wherein said interleaved system of fillets and tangs on said buckets and wheelposts act to reduce stresses acting on said fitted buckets and wheelposts, the fillets and tangs of said interleaved system of fillets and tangs each being formed by a combination of curved and straight surfaces [Figs. 1, 2A and 2B; Paragraphs 11, 26, 29-31 and 33-36];

wherein for each one of said wheelposts the distance from the bottom of the bottom most fillet to the upper most straight portion of the upper most tang is 1.4530 inches [Fig. 11; Paragraph 60].

56.   The turbine as claimed in claim 55, wherein for each one of said

wheelposts the distance from the bottom of the bottom most fillet to a first intersection point of tangent lines drawn along pressure faces of the fillet adjacent to the bottom most fillet is 0.5251 inches [Fig. 11; Paragraph 60].

59.   The turbine as claimed in claim 55, wherein for each one of said wheelposts the angle between the upper most straight portion of the upper most tang and the upper most straight portion of the upper most fillet is 50 degrees [Fig. 11; Paragraphs 46 and 57].

60.   The turbine as claimed in claim 56, wherein for each one of said wheelposts the angle between the upper most straight portion of the upper most tang and the upper most straight portion of the upper most fillet is 50 degrees [Fig. 11; Paragraphs 46 and 57].

(VI) GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A.   Whether claims 10, 12-20 and 29-40 are properly rejected under 35

U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out

and distinctly claim the subject matter which applicant regards as the invention. It is

noted that the Examiner's rejection of claim 29 to the extent that "the straight surfaces"

lack antecedent basis is not being appealed, that Appellant acquiesces in the rejection

of claim 29 on this basis but asks that the rejection be held in abeyance pending the

Board's decision on the appealed issues in this case, at which time Appellant will

correct the antecedent basis problem in claim 29 in accordance with the Board's

decision in this Appeal. See Office Action at page 3, lines 6-7.

B.   Whether claim 29 is anticipated under 35 U.S.C. § 102(b) by Heinig.

C.   Whether claims 10, 13-19 and 52-53 would have been obvious under 35

U.S.C. § 103(a) over Johnson in view of Applicants' Prior Art.

D.   Whether claim 12 would have been obvious under 35 U.S.C.

§103(a) over Johnson and Applicants' Prior Art in view of United Kingdom 677,142

(hereinafter "the '142 patent").

E.   Whether claim 20 would have been obvious under 35 U.S.C. §103(a) over

Johnson and Applicants' Prior Art in view of Caruso over Heinig and applicants' Prior Art

in view of Caruso.

F. ,   Whether claims 10, 16-17, 19, 44-45, 55-56 and 59-60 would have been

obvious under 35 U.S.C. § 103(a) over Heinig in view of Applicants' Prior Art.

G.   Whether claims 29-33 would have been obvious under 35 U.S.C. § 103(a) over Johnson.

H.   Whether claims 34-40 would have been obvious under 35 U.S.C. §103(a) over Johnson in view of Leonardi.

I.   Whether claims 41-43 would have been obvious under 35 U.S.C. §103(a) over Pisz in view of Applicants' Prior Art.

J.   Whether claims 48-49 would have been obvious under 35 U.S.C. §103(a) over Heinig and Applicants' Prior Art in view of Phipps.

(VII) ARGUMENT

A.   Whether claims 10, 12-20 and 29-40 are properly rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 10 and 29 and their respective dependent claims 12-20 and 30-40 require a specific angular relationship between the center line of the bucket and a line defined by tangent lines drawn along the straight surfaces of each of the two upper most tangs on each side of the bucket. Both of independent claims 10 and 29 require in relevant part:

> wherein the straight surfaces of each of the two uppermost tangs on each side of a center line bisecting each of said buckets define two points of a respective line that form an angle of 25.78° with the center line; and . . .

This relationship is shown in Figure 10 where in viewing, for example, the right hand side of the bucket, tangent lines drawn along the straight surfaces of right hand tang 22 and right hand tang 23 (the two uppermost tangs on the right hand side of the bucket) define two points of a line that forms an angle E with the centerline. The angle E (on each side of the bucket) formed by these two lines equals 25.78 degrees.

The Examiner has rejected claims 10 and 29 because he has misinterpreted the relevant claim language and implies that Appellant's requirement that "the straight surfaces of each of the two uppermost tangs on each side of a centerline bisecting each of the buckets" means that only the single uppermost tang on each side of the bucket, i.e., tang 22 in Appellant's Figure 10 is utilized to "define a point of a line that forms an

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angle of 25.78 degrees." See, Office Action at page 3 (emphasis in original). Thus the Examiner has misinterpreted the claim language that requires the use of two tangs on each side of the bucket to define the line that forms angle E with the center line, as required by the above referenced relevant portion of claim 10.

Moreover, the Examiner's interpretation of the claim language is also erroneous because a line cannot properly be defined by a single point and, by doing so, leads to the incongruous result of allowing a line being drawn through the single determined point at any angle, including the angle required by the claim. In other words, the Examiner's misinterpretation of the claim language renders the limitation meaningless since using the Examiner's misinterpretation of the claim it is possible to draw a line through the single determined point (by tangent lines from a single tang, i.e., tang 22) at any angle (including an angle of 25.78 degrees).

Accordingly, the Examiner's rejections of claims 10, 12-20 and 29-40 on the basis that claims 10 and 29 should be amended to define a line utilizing a single point defined by tangent lines along a single tang is in error and should be reversed.

The Examiner has also rejected claim 12 stating that "fillets" is inaccurate and should be changed to - - tangs- -. Appellant respectfully submits that the Examiner is in error and that claim 12 is fully supported in the application by Figures 9 and 10, and paragraph 46 wherein the angles of fillets 25, 26 and 27 are given by angles A, B and F, respectively, as 50.000°, 52.940°, and 58.079°. Accordingly, the Examiner's rejection of claim 12 is also in error and should be reversed.

Finally, the Examiner has rejected claim 29 because "straight surfaces" lacks antecedent basis. As noted previously, Appellant acquiesces with this rejection but

asks that it be held in abeyance until the Board's decision with regards to the appealed issues in this case, at which time Appellant will correct the antecedent basis problem in claim 29 in accordance with the Board's decision in this Appeal.

B.   Whether claim 29 is anticipated under 35 U.S.C. § 102(b) by Heinig.

In rejecting claims 29 as being anticipated Heinig, the Examiner has made the same error in rejecting this claim under 35 U.S.C. 112, second paragraph, discussed above. Namely, the Examiner has erroneously used a single upper tang (one on each side of the bucket) to determine a single point used to define a line forming an angle of 25.78° with the center line of the bucket. If the two uppermost tangs on each side of the bucket disclosed in the reference are used, as required by the claim language, to define the line then the angle formed between that line and the center line is approximately 15° not the required 25.78°.

Moreover, the line defined by the two uppermost tangs on each side of the bucket must necessarily lie along tangent lines to the pressure faces of the bottom most tang, since Heinig only has two tangs and the bottommost tang must be used to define the line forming an angle of 25.78° with the center line of the bucket, the bottommost tang of Heinig must lie along the defined line in contravention of the claim language. Thus, Heinig does not meet the last limitation in claim 29 "wherein a point defined by intersecting tangent lines along the pressure faces of the bottommost tang does not lie on either line that forms the angle of 25.78° with the center line."

Additionally, Heinig does not disclose a bucket having tangs formed from multiple straight surfaces, as required by claim 29. Heinig discloses that each of its two tangs are formed from curved surfaces having radii of R1 through R8 and a <u>single flat bearing</u>

surface b_1 (for the uppermost tang) and b_2 (for the bottommost tang) as shown in Figure 1 and described at column 4, line 42 through column 5, line 57.

Finally, it is clear that Heinig only discloses a bucket having two tangs (referred to as uppermost lug 22 and lowermost lug 26) and, therefore, does not meet the claim language of claim 29 that requires three tangs – the two uppermost tangs being used to determine the lines that form the required angular relationship with the center line, and wherein the bottommost tang does not lie along either of the determined lines.

C.   Whether claims 10, 13-19 and 52-53 would have been obvious under 35 U.S.C. § 103(a) over Johnson in view of Applicants' Prior Art.

In rejecting claims 10, 13-19, and 52-53 as being unpatentable over Johnson in view of Applicant's Prior Art, the Examiner has erroneously applied Johnson for the same reasons given above with respect to the Examiner's 35 U.S.C. 112, second paragraph, rejection of claim 10, and because neither Johnson nor Applicant's Prior Art teach or suggest a wheelpost having a fillet with a radius of curvature of 0.0855 inches as required by claim 52. Applicant's Prior Art has only been cited by the Examiner for disclosing "that as many as 92 buckets are present in a turbine" and, therefore, clearly does not solve the deficiencies of Johnson noted above with respect to independent claims 10 and 52.

More particularly, Johnson does not teach or suggest the angular relationship – defined in part by the two uppermost tangs on either side of the bucket – required by independent claim 10. The Examiner has erroneously used a single tang on Johnson to determine a single point through which any line can be drawn to form any angle with the center line of the bucket. In Johnson, a line defined by the two uppermost tangs of the

bucket is shown in Figure 1 as line "TN" and is described in the specification, at column 4, lines 7-9, to be 15.75° not 25.78° as required by claim 10.

With respect to claim 52, Johnson does not teach or suggest a wheelpost fillet having a radius of curvature of 0.0855 inches, as required by claim 52, nor an additional wheelpost fillet having a radius of curvature of 0.0752 inches, as required by claim 53. Johnson actually only discloses tangs on a bucket which the Examiner apparently assumes mirrors the fillets on a wheelpost which is not shown or described in Johnson. In any event, the tangs/fillets of Johnson have multiple radii of curvature and not a single radius of curvature as required by claims 52 and 53. More particularly, the first tang/fillet of Johnson has radii R3 and R4 which although equal in value are effectively two different radii because they are measured from two different points R3C and R4C, respectively. Similarly, the second tang/fillet has radii of R7 and R8 which although equal in value are effectively two different radii because they are measured from two different points R7C and R8C, respectively. See, Johnson at Figure 1 and column 3, lines 30-38 and 48-53. Thus, the tangs/fillets disclosed in Johnson do not meet the claim limitations of claims 52-53.

The Examiner admits that Johnson does not disclose the specific angular relationship required by claim 10 (and dependent claims 13-19) nor the specific dimensional requirement for the fillets in claim 52 and 53, but asserts that such specific constructions are mere mattes of choice in design and cites In re Boesch, 617 F.2d 272 (CCPA 1980) for support of this assertion. However, In re Boesch involved a chemical composition case in which there were overlapping ranges between the claimed constituents and those disclosed in the prior art. In addition, the cited case involved an

alleged unexpected result for the concentration of a single constituent material. Neither of these factors are present here and, accordingly, the case law submitted by the Examiner is inapposite.

Claims 10, 13-19 and 52-53 require specific dimensions for specific structures, and do not merely recite ranges. Moreover, these claims recite multiple specific dimensions and configurations (i.e., fillets and tangs being formed by a combination of curved and straight surfaces, the tangs having specific angular relationship to the center line of the bucket, and/or the fillets having specific radii of curvature) for multiple structures from among an infinite number of possibilities for the dimensions, configurations and angular relationships of the specific tangs and fillets. The Supreme Court's recent *KSR* decision, stated:

> When there is a design need or market pressure to solve a problem <u>and there are a finite number of identified, predictable solutions</u>, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. In that instance the fact that a combination was obvious to try might show that it was obvious under §103.

KSR Int'l v. Telefex, Inc., 550 U.S. ____ (2007) at p.17 (emphasis supplied). Thus, under *KSR* Appellants' invention would not have been obvious, since there were virtually an infinite number of options for the specific number, angular relationships between, and dimensions of the tangs and fillets of the buckets and wheelposts the specific relationships and dimensions arrived at in these claims and <u>not</u> a finite number of identified, predictable solutions.

For all of these reasons it is improper for the Examiner to allege that the specific recitations of these claims are mere matters of design choice. Accordingly, claims 10, 13-19 and 52-52 are believed to patentably define over the cited art, taken singly or in combination and, therefore, the Examiner's rejection of these claims should be reversed.

D.   Whether claim 12 would have been obvious under 35 U.S.C. §103(a) over Johnson and Applicants' Prior Art in view of United Kingdom 677,142 (hereinafter "the '142 patent").

In rejecting claim 12, the Examiner has relied on a combination of Johnson, Applicant's Prior Art, and United Kingdom Patent 677,142 (hereinafter "the '142 patent"). As noted above, neither Johnson nor Applicant's Prior Art teach or suggest the required angular relationship of 25.78° between the specifically determined line (using the two uppermost tangs on each side of the bucket) and the center line of the bucket as required by independent claim 10 from which claim 12 depends. Since, the '142 patent has only been cited for disclosing bucket <u>tangs</u> having an angle of 55 degrees it should be clear that this reference does not solve the deficiency noted above regarding the required angular relationship of 25.78°. Indeed, Figure 1 of the '142 patent clearly indicates that the required angular relationship would be only 15° (i.e., half of the 30° angle shown in Figure 1 of the '142 patent). Accordingly, it is respectfully submitted that claim 12 patentably defines over the cited art, taken singly or in any combination, and that the Examiner's rejection of this claim should be reversed.

E.   Whether claim 20 would have been obvious under 35 U.S.C. §103(a) over

Johnson and Applicants' Prior Art in view of Caruso over Heinig and applicants' Prior Art

in view of Caruso.

In rejecting claim 20, over a combination of Johnson, Applicant's Prior Art, and

Caruso, or a combination of Heinig, Applicant's Prior Art, and Caruso the Examiner

merely cites Caruso for disclosing that the "outer tang edge of each wheelpost is

scalloped." Thus, it should be clear that Caruso does not solve the deficiencies noted

above with respect to Johnson and Applicant's Prior Art as applied against independent

claim 10. Nor does Caruso solve the deficiencies noted above with respect to Heinig as

applied against claim 29 which requires the same angular relationship of claim 10.

More particularly, none of these references teaches or suggest the required angular

relationship of independent claim 10 from which claim 20 depends. Accordingly, claim

20 is believed to patentably define over the cited art taken singly or in any combination.

Moreover, contrary to the Examiner's assertion, Caruso does not teach anywhere

in its disclosure providing scalloped wheelposts as required by claim 20. Caruso is

concerned with a system that provides for the final bucket to be radially inserted thereby

allowing interlocking covers 18 to mate. See, Caruso at Figures 1-3 and column 3, line

32 to column 4, line 22. There is simply no mention anywhere in Caruso of providing

scalloped wheelposts to reduce the weight of the wheel, as required by claim 20.

Apparently, the Examiner has misinterpreted Figure 1 (the only figure directed to the

wheel in Caruso) as showing "scalloped tangs." Figure 1 merely shows two protrusions,

i.e., additional material not removed material, on the outer tang of wheel 10 and does

not otherwise describe or even identify the protrusions with a reference numeral

anywhere in its specification. Accordingly, it is respectfully submitted that absent the hindsight provided by Appellant's application no one skilled in the art would have considered the protrusions of the Caruso reference as disclosing scalloped wheelposts. Therefore, claim 20 is believed to patentably define over the cited references for this additional reason.

F.   Whether claims 10, 16-17, 19, 44-45, 55-56 and 59-60 would have been obvious under 35 U.S.C. § 103(a) over Heinig in view of Applicants' Prior Art.

In applying Heinig against independent claim 10, the Examiner has committed the same error described above with respect to its application against independent claim 29 and in rejecting claim 10 under 35 U.S.C. 112, second paragraph, also discussed above. Namely, the Examiner has erroneously used a single upper tang (one on each side of the bucket) to determine a single point used to define a line forming an angle of 25.78° with the center line of the bucket. If the two uppermost tangs on each side of the bucket disclosed in Heinig are used, as required by claim 10, to define the line then the angle formed between that line and the center line is approximately 15° not the required 25.78°.

Moreover, claim 10 further requires that a point defined by intersecting tangent lines along the pressure faces of the bottommost tang does not lie along the line that forms the angle of 25.78° with the center line. Since Heinig only has two tangs, the bottommost tang must be used to define the line forming an angle of 25.78° with the center line of the bucket, and it necessarily must lie along the line it was used to define contrary to the required claim language. Thus, Heinig does not and cannot meet the last limitation of claim 10.

Additionally, Heinig does not disclose a bucket having tangs formed from multiple straight surfaces, as required by claim 10. Heinig discloses that each of its two tangs are formed from curved surfaces having radii of R1 through R8 and a single flat bearing surface b_1 (for the uppermost tang) and b_2 (for the bottommost tang) as shown in Figure 1 and described at column 4, line 42 through column 5, line 57. Finally, it is clear that Heinig only discloses a bucket having two tangs (referred to as uppermost lug 22 and lowermost lug 26) and, therefore, does not meet the claim language of claim 10 that requires three tangs — the two uppermost tangs being used to determine the lines that form the required angular relationship with the center line, and wherein the bottommost tang does not lie along either of the determined lines.

Applicant's Prior Art has only been cited by the Examiner for disclosing that as many as 92 buckets are present in a turbine and, therefore, clearly does not solve the deficiencies of Heinig noted above with respect to independent claim 10.

Indeed, the Examiner admits that neither Heinig nor Applicant's Prior Art disclose the specific angular relationship of claims 10, 16-17, and 19 nor the specific dimensional relationships for the fillets and tangs of claims 44-45, 55-56 and 59-60. In rejecting the claims the Examiner improperly asserts that the specific angular and dimensional relationships given for the fillets and tangs in these claims are mere matters of choice in design, and cites to *In re Boesch*, 617 F.2d 272 (CCPA 1980) for support of his assertion. However, as previously noted, *In re Boesch* involved a chemical composition case in which there were overlapping ranges between the claimed constituents and those disclosed in the prior art. In addition, the cited case law involved an alleged unexpected result for the concentration of a single constituent material. Neither of these

factors are present here and, accordingly, the case law cited by the Examiner is inapposite.

Each of the rejected claims require specific angular and dimensional relationships for specific structures, and do not merely recite ranges. Moreover, the rejected claims require multiple specific dimensions and configurations for multiple structures from among an infinite number of possibilities for the dimensional relationships of the specific tangs and fillets. The Supreme Court's recent *KSR* decision, stated:

> When there is a design need or market pressure to solve a problem <u>and there are a finite number of identified, predictable solutions</u>, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. In that instance the fact that a combination was obvious to try might show that it was obvious under §103.

KSR Int'l v. Telefex, Inc., 550 U.S. _____ (2007) at p.17 (emphasis supplied). Thus, under *KSR* Appellants' invention would not have been obvious, since there were virtually an infinite number of options for the specific number, angular relationships between, and dimensions of the tangs and fillets of the buckets and wheelposts the specific relationships and dimensions arrived at in these claims and <u>not</u> a finite number of identified, predictable solutions.

For all of these reasons it is improper for the Examiner to allege that the specific recitations of these claims are mere matters of design choice. Accordingly, the rejected claims are believed to patentably define over the cited art, taken either singly or in

combination, and, therefore, the Examiner's rejection of the claims should be reversed.

G. Whether claims 29-33 would have been obvious under 35 U.S.C. § 103(a) over Johnson.

In rejecting claims 29-33 as being obvious over Johnson, the Examiner has made the same error in rejecting these claims under 35 U.S.C. 112, second paragraph, discussed above. Namely, the Examiner has erroneously used a single upper tang (one on each side of the bucket) to determine a single point used to define a line forming an angle of 25.78° with the center line of the bucket. More particularly, Johnson does not teach or suggest the angular relationship – defined in part by the two uppermost tangs on either side of the bucket – required by independent claim 29. The Examiner has erroneously used a single tang on Johnson to determine a single point through which any line can be drawn to form any angle with the center line of the bucket. In Johnson, a line defined by the two uppermost tangs of the bucket is shown in Figure 1 as line "TN" and is described in the specification, at column 4, lines 7-9, to be 15.75° not 25.78° as required by claim 29.

The Examiner admits that Johnson does not disclose the specific angular relationship required by claim 29 (and dependent claims 30-33) nor the specific dimensional requirement for the bottom tang in claim 33, but asserts that such specific constructions are mere mattes of choice in design and cites In re Boesch, 617 F.2d 272 (CCPA 1980) for support of this assertion. However, as noted previously, In re Boesch involved a chemical composition case in which there were overlapping ranges between the claimed constituents and those disclosed in the prior art. In addition, the cited case involved an alleged unexpected result for the concentration of a single constituent

material. Neither of these factors are present here and, accordingly, the case law submitted by the Examiner is inapposite.

Claims 29-33 require specific dimensions for specific structures, and do not merely recite ranges. Moreover, these claims recite multiple specific dimensions and configurations (i.e., fillets and tangs being formed by a combination of curved and straight surfaces, the tangs having specific angular relationship to the center line of the bucket, and/or the fillets having specific radii of curvature) for multiple structures from among an infinite number of possibilities for the dimensions, configurations and angular relationships of the specific tangs and fillets. The Supreme Court's recent *KSR* decision, stated:

> When there is a design need or market pressure to solve a problem <u>and there are a finite number of identified, predictable solutions</u>, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. In that instance the fact that a combination was obvious to try might show that it was obvious under §103.

KSR Int'l v. Telefex, Inc., 550 U.S. ____ (2007) at p.17 (emphasis supplied). Thus, under *KSR* Appellants' invention would not have been obvious, since there were virtually an infinite number of options for the specific number, angular relationships between, and dimensions of the tangs and fillets of the buckets and wheelposts the specific relationships and dimensions arrived at in these claims and <u>not</u> a finite number of identified, predictable solutions.

For all of these reasons it is improper for the Examiner to allege that the specific recitations of these claims are mere matters of design choice. Accordingly, claims 29-33 are believed to patentably define over the cited art, taken singly or in combination and, therefore, the Examiner's rejection of these claims should be reversed.

H.   Whether claims 34-40 would have been obvious under 35 U.S.C. §103(a) over Johnson in view of Leonardi.

In rejecting claims 34-40 the Examiner has relied on a combination of Johnson and Leonardi. As noted above, Johnson does not teach or suggest the required angular relationship of 25.78° between the specifically determined line (using the two uppermost tangs on each side of the bucket) and the centerline in independent claim 29 from which claims 34-40 depends. Since Leonardi has only been cited for disclosing tangs formed from curved surfaces with more than one radii of curvature, it should be clear that this reference does not solve the deficiency of Johnson as noted above regarding the required angular relationship of 25.78°. Accordingly, it is respectfully submitted that claims 34-40 patentably define over Johnson and Leonardi, taken singly or in combination, and that the Examiner's rejection of these claims should be reversed.

I.   Whether claims 41-43 would have been obvious under 35 U.S.C. §103(a) over Pisz in view of Applicants' Prior Art.

The Examiner admits that neither Pisz nor Applicant's Prior Art disclose the specific dimensional relationships for the fillets and tangs as required by claims 41-43. In rejecting the claims the Examiner improperly asserts that the specific dimensions given for the fillets and tangs in claims 41-43 are mere "matters of choice in design" and cites to *In re Boesch*, 617 F.2d 272 (CCPA 1980) for support of his assertion. However,

as previously noted, *In re Boesch* involved a chemical composition case in which there were overlapping ranges between the claimed constituents and those disclosed in the prior art. In addition, the cited case law involved an alleged unexpected result for the concentration of a single constituent material. Neither of these factors are present here and, accordingly, the case law cited by the Examiner is inapposite.

Claims 41-43 require specific dimensions for specific structures, and do not merely recite ranges. Moreover, the dependant claims 42-43 recite multiple specific dimensions and configurations for multiple structures from among an infinite number of possibilities for the dimensions and angular relationships of the specific tangs and fillets. The Supreme Court's recent *KSR* decision, stated:

> When there is a design need or market pressure to solve a problem <u>and there are a finite number of identified, predictable solutions</u>, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. In that instance the fact that a combination was obvious to try might show that it was obvious under §103.

KSR Int'l v. Telefex, Inc., 550 U.S. ____ (2007) at p.17 (emphasis supplied). Thus, under *KSR* Appellants' invention would not have been obvious, since there were virtually an infinite number of options for the specific number, angular relationships between, and dimensions of the tangs and fillets of the buckets and wheelposts the specific relationships and dimensions arrived at in these claims and <u>not</u> a finite number of identified, predictable solutions.

For all of these reasons it is improper for the Examiner to allege that the specific

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recitations of claims 41-43 are mere matters of design choice. Accordingly, claims 41-43 are believed to patentably define over the cited art, taken either singly or in combination, and, therefore, the Examiner's rejection of the claims should be reversed.

    J.   Whether claims 48-49 would have been obvious under 35 U.S.C. §103(a) over Heinig and Applicants' Prior Art in view of Phipps.

In rejecting claims 48-49 the Examiner has applied Phipps in combination with Heinig and Applicant's Prior Art. The Examiner admits that none of the cited references discloses any of the specific dimensions for the tangs and fillets required by the rejected claims.

Indeed, Phipps is only being cited for disclosing 55° for the angle between the upper most straight portion of the upper most fillet and the upper most straight portion of the upper most tang instead of the required angle of 50° in claims 48 and 49. Moreover, Phipps does not even disclose the Examiner's alleged angle of 55° anywhere in its specification. Nor is there any figure in Phipps from which an accurate measurement of the angle could be obtained – Figures 1 and 2 are perspective drawings and Figure 3 is a partial drawing that does not even show the upper fillet and tang from which the required angle could be measured.

Since none of the cited references teach or suggest the specific dimensional and angular relationships of the tangs and fillet required by claims 48 and 49, these claims are believed to patentably define over the cited art taken singly or in combination.

<u>CONCLUSION</u>

In conclusion it is believed that the application is in clear condition for allowance; therefore, early reversal of the Final Rejection and passage of the subject application to issue are earnestly solicited.

Respectfully submitted,

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VIII.   CLAIMS APPENDIX

10.   A turbine having multiple turbine stages, a third turbine stage comprising:

a wheel having ninety wheelposts, each having an interleaved system of fillets and tangs; and

a plurality of buckets each having a corresponding interleaved system of fillets and tangs so that said plurality of buckets can be fitted, one to one, into said ninety wheelposts on said wheel;

wherein said interleaved system of fillets and tangs on said buckets and wheelposts act to reduce stresses acting on said fitted buckets and wheelposts, the fillets and tangs of said interleaved system of fillets and tangs each being formed by a combination of curved and straight surfaces;

wherein the straight surfaces of each of the two uppermost tangs on either side of a center line bisecting each of said buckets define two points of a line that form an angle of 25.78° with the center line; and

wherein a point defined by intersecting tangent lines along the pressure faces of the bottommost tang does not lie on either line that forms the angle of 25.78° with the center line.

12.   A turbine as claimed in claim 10, wherein the fillets formed on said plurality of buckets have angles ranging from 50° to 59°.

13.   A turbine as claimed in claim 10, each one of said buckets and wheelposts having three interleaved tangs and fillets.

14.   A turbine as claimed in claim 13, wherein each of said buckets having a bottom tang formed from curved surfaces having more than one radius of curvature.

15.   A turbine as claimed in claim 14, wherein each of said buckets further includes at least one straight surface.

16.   A turbine as claimed in claim 10, wherein each of said wheelposts having a bottom fillet formed from curved surfaces having more than one radius of curvature.

17.   A turbine as claimed in claim 16, wherein each of said wheelposts further includes at least one straight surface.

18.   A turbine as claimed in claim 14, wherein said curved surfaces have radii of curvatures of .1992 inches and .3360 inches.

19.   A turbine as claimed in claim 16, wherein said curved surfaces have radii of curvatures of .2052 inches and .3420 inches.

20.   A turbine as claimed in claim 10, wherein a top surface of each one of said wheelposts being scalloped so as to reduce the weight of said wheel.

29.   A bucket for insertion into a wheelpost of a turbine rotor, said bucket being formed from interleaved fillets and tangs which complement interleaved fillets and tangs formed in the wheelpost,

wherein the straight surfaces of each of the two uppermost tangs on either side of a center line bisecting each of said buckets define two points of a line that form an

angle of 25.78° with the center line; and

wherein a point defined by intersecting tangent lines along the pressure faces of the bottommost tang does not lie on either line that forms the angle of 25.78° with the center line.

30. A bucket as claimed in claim 29, said bucket having three interleaved tangs and fillets.

31. A bucket as claimed in claim 30, said bucket having a bottom tang formed from curved surfaces having more than one radius of curvature.

32. A bucket as claimed in claim 31, said bucket further including at least one straight surface.

33. A bucket as claimed in claim 31, said curved surfaces having radii of curvatures of .1992 inches and .3360 inches.

34. A bucket as claimed in claim 30, said bucket having an upper tang formed from curved surfaces having more than one radius of curvature.

35. A bucket as claimed in claim 31, said bucket having an upper tang formed from curved surfaces having more than one radius of curvature.

36. A bucket as claimed in claim 34, said bucket further including at least one straight surface.

37.   A bucket as claimed in claim 30, said bucket having an intermediate tang formed from curved surfaces having more than one radius of curvature.

38.   A bucket as claimed in claim 31, said bucket having an intermediate tang formed from curved surfaces having more than one radius of curvature.

39.   A bucket as claimed in claim 35, said bucket having an intermediate tang formed from curved surfaces having more than one radius of curvature.

40.   A bucket as claimed in claim 37, said bucket further including at least one straight surface.

41.   A turbine having multiple turbine stages, a third turbine stage comprising:

a wheel having ninety wheelposts, each having an interleaved system of fillets and tangs; and

a plurality of buckets each having a corresponding interleaved system of fillets and tangs so that said plurality of buckets can be fitted, one to one, into said ninety wheelposts on said wheel;

wherein said interleaved system of fillets and tangs on said buckets and wheelposts act to reduce stresses acting on said fitted buckets and wheelposts, the fillets and tangs of said interleaved system of fillets and tangs each being formed by a combination of curved and straight surfaces;

wherein above the uppermost tang on each of said buckets there is a compound fillet having a first radius of curvature of 0.3376 inches and a second radius curvature of 0.0718 inches.

42.   The turbine as claimed in claim 41, wherein below the upper most tang on each of said buckets there is a fillet having a radius of curvature of 0.0656 inches.

43.   The turbine as claimed in claim 42, wherein above the bottom most tang on each of said buckets there is a fillet having a radius of curvature of 0.0695 inches.

44.   A turbine having multiple turbine stages, a third turbine stage comprising:

a wheel having ninety wheelposts, each having an interleaved system of fillets and tangs; and

a plurality of buckets each having a corresponding interleaved system of fillets and tangs so that said plurality of buckets can be fitted, one to one, into said ninety wheelposts on said wheel;

wherein said interleaved system of fillets and tangs on said buckets and wheelposts act to reduce stresses acting on said fitted buckets and wheelposts, the fillets and tangs of said interleaved system of fillets and tangs each being formed by a combination of curved and straight surfaces;

wherein for each one of said plurality of buckets the distance from the bottom of the bottom most tang to the upper most straight portion of the upper most fillet is 1.4530 inches.

45.   The turbine as claimed in claim 44, wherein for each one of said plurality of buckets the distance from the bottom of the bottom most tang to a first intersection

point of tangent lines drawn along pressure faces of the tang adjacent to the bottom most tang is 0.5249 inches.

46.   The turbine as claimed in claim 45, wherein for each one of said plurality of buckets the distance from the bottom of the bottom most tang to a second intersection point of tangent lines drawn along pressure faces of the upper most tang is 0.8191 inches.

47.   The turbine as claimed in claim 46, wherein for each one of said plurality of buckets the distance from the bottom of the bottom most tang to a point defined by the intersection of a line through said first and second intersection points and a tangent line along an upper straight surface of the bottom most tang is 0.2407 inches.

48.   The turbine as claimed in claim 44, wherein for each one of said plurality of buckets the angle between the upper most straight portion of the upper most fillet and the upper most straight portion of the upper most tang is 50 degrees.

49.   The turbine as claimed in claim 45, wherein for each one of said plurality of buckets the angle between the upper most straight portion of the upper most fillet and the upper most straight portion of the upper most tang is 50 degrees.

50.   The turbine as claimed in claim 46, wherein for each one of said plurality of buckets the angle between the upper most straight portion of the upper most fillet and

the upper most straight portion of the upper most tang is 50 degrees.

51.   The turbine as claimed in claim 47, wherein for each one of said plurality of buckets the angle between the upper most straight portion of the upper most fillet and the upper most straight portion of the upper most tang is 50 degrees.

52.   A turbine having multiple turbine stages, a third turbine stage comprising:

a wheel having ninety wheelposts, each having an interleaved system of fillets and tangs; and

a plurality of buckets each having a corresponding interleaved system of fillets and tangs so that said plurality of buckets can be fitted, one to one, into said ninety wheelposts on said wheel;

wherein said interleaved system of fillets and tangs on said buckets and wheelposts act to reduce stresses acting on said fitted buckets and wheelposts, the fillets and tangs of said interleaved system of fillets and tangs each being formed by a combination of curved and straight surfaces;

wherein below the uppermost tang on each of said wheelposts there is a fillet having a radius of curvature of 0.0855 inches.

53.   The turbine as claimed in claim 52, wherein above the bottom most tang on each of said wheelposts there is a fillet having a radius of curvature of 0.0752 inches.

54.   The turbine as claimed in claim 53, wherein below the bottom most tang on each of said wheelposts there is a compound fillet having a first radius of curvature of 0.2052 inches and a second radius of curvature of 0.3420 inches, the first radius of curvature being measured from two points equally offset 0.0465 inches from either side of a center line bisecting each of said wheelposts and at a distance of 0.2134 inches from the bottom of said compound fillet, and the second radius of curvature being measured from the center line bisecting each of said wheelposts at a distance of 0.3420 inches from the bottom of said compound fillet.

55.   A turbine having multiple turbine stages, a third turbine stage comprising:

a wheel having ninety wheelposts, each having an interleaved system of fillets and tangs; and

a plurality of buckets each having a corresponding interleaved system of fillets and tangs so that said plurality of buckets can be fitted, one to one, into said ninety wheelposts on said wheel;

wherein said interleaved system of fillets and tangs on said buckets and wheelposts act to reduce stresses acting on said fitted buckets and wheelposts, the fillets and tangs of said interleaved system of fillets and tangs each being formed by a combination of curved and straight surfaces;

wherein for each one of said wheelposts the distance from the bottom of the bottom most fillet to the upper most straight portion of the upper most tang is 1.4530 inches.

56.   The turbine as claimed in claim 55, wherein for each one of said wheelposts the distance from the bottom of the bottom most fillet to a first intersection point of tangent lines drawn along pressure faces of the fillet adjacent to the bottom most fillet is 0.5251 inches.

57.   The turbine as claimed in claim 56, wherein for each one of said wheelposts the distance from the bottom of the bottom most fillet to a second intersection point of tangent lines drawn along pressure faces of the upper most fillet is 0.8193 inches.

58.   The turbine as claimed in claim 57, wherein for each one of said wheelposts the distance from the bottom of the bottom most fillet to a point defined by the intersection of a line through said first and second intersection points and a tangent line along an upper straight surface of the bottom most fillet is 0.2409 inches.

59.   The turbine as claimed in claim 55, wherein for each one of said wheelposts the angle between the upper most straight portion of the upper most tang and the upper most straight portion of the upper most fillet is 50 degrees.

60.   The turbine as claimed in claim 56, wherein for each one of said wheelposts the angle between the upper most straight portion of the upper most tang and the upper most straight portion of the upper most fillet is 50 degrees.

61.   The turbine as claimed in claim 57, wherein for each one of said wheelposts the angle between the upper most straight portion of the upper most tang and the upper most straight portion of the upper most fillet is 50 degrees.

62.   The turbine as claimed in claim 58, wherein for each one of said wheelposts the angle between the upper most straight portion of the upper most tang and the upper most straight portion of the upper most fillet is 50 degrees.

IX.   EVIDENCE APPENDIX

None.

X.   RELATED PROCEEDINGS APPENDIX

None.